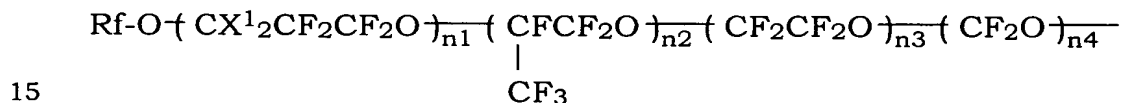


# CLAIMS

1. A curable surface modifier comprising a curable fluorine-containing resin (I) which is soluble in general purpose solvents and comprises a fluorine-containing ethylenic polymer (IAB) having a moiety A and a moiety B in at least a part of the same side chain or different side chains thereof or comprises a fluorine-containing ethylenic polymer (IA) having a moiety A in at least a part of its side chain and a fluorine-containing ethylenic polymer (IB) having a moiety B in at least a part of its side chain, in which the moiety A has, at its end, one or two or more polyfluoropolyether chains P represented by the formula (1):

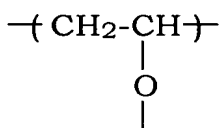


wherein n1, n2, n3 and n4 are the same or different and each is 0 or an integer of 1 or more and n1 + n2 + n3 + n4 is an integer of 7 to 40; X<sup>1</sup> are the same or different and each is H, F or Cl; Rf is a fluorine-containing alkyl group having 1 to 10 carbon atoms, the moiety B has one or two or more self-crosslinkable functional groups Y at its end, and an ethylenic polymer moiety M remaining by excluding the moiety A and the moiety B from the fluorine-containing ethylenic polymer constituting the resin (I) does not contain fluorine atom or is an ethylenic polymer moiety in which a part of hydrogen atoms thereof are replaced by fluorine atoms up to a fluorine content of not more than

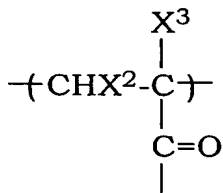
10 % by weight.

2. The curable surface modifier of Claim 1, wherein the  
fluorine content of curable fluorine-containing resin (I) which is soluble  
5 in general purpose solvents is not less than 0.1 % by weight and not  
more than 35 % by weight.

3. The curable surface modifier of Claim 1 or 2, wherein the  
ethylenic polymer moiety M contains a structural unit of the formula  
10 (2):



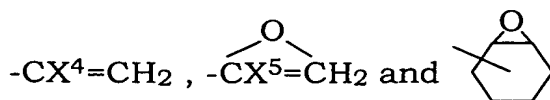
15 or the formula (3):



20

wherein X<sup>2</sup> is H or a bond; X<sup>3</sup> is H, F or CH<sub>3</sub>.

4. The curable surface modifier of any of Claims 1 to 3,  
wherein the self-crosslinkable functional group Y of the moiety B is at  
25 least one selected from the group consisting of



wherein  $X^4$  is H,  $CH_3$  or F;  $X^5$  is H or  $CH_3$ .

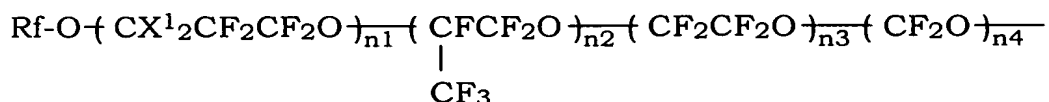
5        5. A method of modifying a surface of a substrate which comprises applying the curable surface modifier of any of Claims 1 to 4 on the substrate and curing.

6. The surface modifying method of Claim 5, wherein the substrate is one having an antireflection film on its surface.

10        7. A surface-modified antireflection film of multi-layer structure which comprises an antireflection film and a continuous or discontinuous cured film of the curable surface modifier of any of Claims 1 to 4 which is formed directly on the antireflection film.

15        8. A curable composition for surface modification which is crosslinkable with active energy rays and comprises:

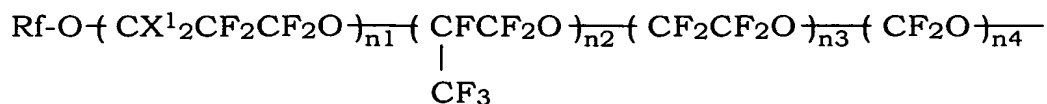
(a) a curable fluorine-containing resin (I) which is soluble in general purpose solvents and comprises a fluorine-containing ethylenic polymer (IAB) having a moiety A and moiety B in at least a part of the  
20 same side chain or different side chains thereof or comprises a fluorine-containing ethylenic polymer (IA) having a moiety A in at least a part of its side chain and a fluorine-containing ethylenic polymer (IB) having a moiety B in at least a part of its side chain, in which the moiety A has, at its end, one or two or more polyfluoropolyether chains  
25 P represented by the formula (1):



- wherein  $n1$ ,  $n2$ ,  $n3$  and  $n4$  are the same or different and each is 0 or an integer of 1 or more and  $n1 + n2 + n3 + n4$  is an integer of 7 to 40;  $X^1$  are the same or different and each is H, F or Cl; Rf is a fluorine-containing alkyl group having 1 to 10 carbon atoms, the moiety B has one or two or more self-crosslinkable functional groups Y at its end, and
- an ethylenic polymer moiety M remaining by excluding the moiety A and the moiety B from the fluorine-containing ethylenic polymer constituting the resin (I) does not contain fluorine atom or is an ethylenic polymer moiety in which a part of hydrogen atoms thereof are replaced by fluorine atoms up to a fluorine content of not more than 10 % by weight, and
- (b) an active energy curing initiator.

9. A curable composition for surface modification which is crosslinkable with active energy rays and comprises:
- (a) a curable fluorine-containing resin (I) which is soluble in general purpose solvents and comprises a fluorine-containing ethylenic polymer (IAB) having a moiety A and moiety B in at least a part of the same side chain or different side chains thereof or comprises a fluorine-containing ethylenic polymer (IA) having a moiety A in at least a part of its side chain and a fluorine-containing ethylenic polymer (IB) having a moiety B in at least a part of its side chain, in which the moiety A has, at its end, one or two or more polyfluoropolyether chains

P represented by the formula (1):



5

wherein n1, n2, n3 and n4 are the same or different and each is 0 or an integer of 1 or more and n1 + n2 + n3 + n4 is an integer of 7 to 40; X<sup>1</sup> are the same or different and each is H, F or Cl; Rf is a fluorine-containing alkyl group having 1 to 10 carbon atoms,

10 the moiety B has one or two or more self-crosslinkable functional groups Y at its end, and

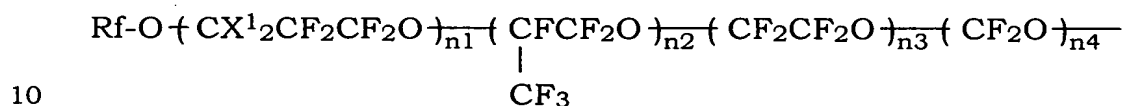
an ethylenic polymer moiety M remaining by excluding the moiety A and the moiety B from the fluorine-containing ethylenic polymer constituting the resin (I) does not contain fluorine atom or is an ethylenic polymer moiety in which a part of hydrogen atoms thereof are replaced by fluorine atoms up to a fluorine content of not more than 10 % by weight,

(b) an active energy curing initiator, and  
(c) at least one general purpose solvent selected from the group  
20 consisting of ketone solvents, acetic acid ester solvents and alcohol solvents or a solvent mixture containing the general purpose solvent.

10. An antireflection film obtained by applying, on a substrate, a composition for forming an antireflection film which  
25 comprises:

(d) a fluorine-containing resin (II) which is soluble in general purpose solvents, has a fluorine content of not less than 1 % by weight and not

more than 35 % by weight and comprises a fluorine-containing ethylenic polymer (IAB) having a moiety A and moiety B in at least a part of the same side chain or different side chains thereof or a fluorine-containing ethylenic polymer (IA) having a moiety A in at least  
 5 a part of its side chain, in which the moiety A has, at its end, one or two or more polyfluoropolyether chains P represented by the formula (1):



wherein n1, n2, n3 and n4 are the same or different and each is 0 or an integer of 1 or more and n1 + n2 + n3 + n4 is an integer of 7 to 40; X<sup>1</sup> are the same or different and each is H, F or Cl; Rf is a  
 15 fluorine-containing alkyl group having 1 to 10 carbon atoms,  
 an ethylenic polymer moiety MA remaining by excluding the moiety A and the moiety B from the fluorine-containing ethylenic polymer constituting the resin (II) does not contain fluorine atom or is an ethylenic polymer moiety in which a part of hydrogen atoms thereof are  
 20 replaced by fluorine atoms up to a fluorine content of not more than 10 % by weight, and  
 (e) a material for antireflection film.

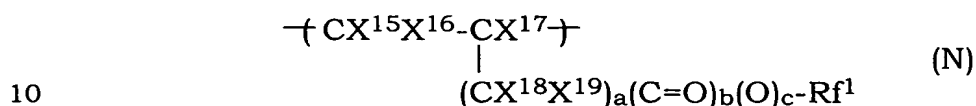
#### 11. A curable resin composition comprising:

25 (1) a curable fluorine-containing resin (III) containing up to 100 % by mole of a fluorine-containing polymer (IIINC) which has a number average molecular weight of 500 to 1,000,000 and is represented by

the formula (4):



5 wherein the structural unit N is a structural unit derived from a fluorine-containing ethylenic monomer and represented by the formula (N):

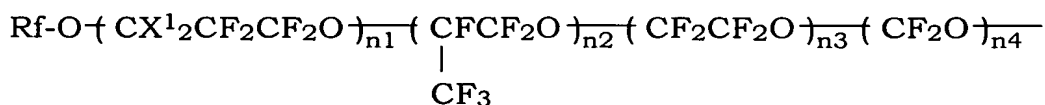


in which X<sup>15</sup> and X<sup>16</sup> are the same or different and each is H or F; X<sup>17</sup> is H, F, CH<sub>3</sub> or CF<sub>3</sub>; X<sup>18</sup> and X<sup>19</sup> are the same or different and each is H, F or CF<sub>3</sub>; Rf<sup>1</sup> is an organic group in which 1 to 3 Y<sup>1</sup> or Y<sup>2</sup> (Y<sup>1</sup> is a  
15 monovalent organic group having 2 to 10 carbon atoms and an ethylenic carbon-carbon double bond at its end and Y<sup>2</sup> is a monovalent organic group having 2 to 100 carbon atoms and 1 to 5 crosslinkable cyclic ether structures, in which hydrogen atoms may be replaced by  
20 1 to 40 carbon atoms or a fluorine-containing alkyl group having 2 to 100 carbon atoms and ether bond; a is 0 or an integer of from 1 to 3; b and c are the same or different and each is 0 or 1,

the structural unit C is a structural unit derived from a monomer copolymerizable with the fluorine-containing ethylenic monomer  
25 providing the structural unit N, and

the structural units N and C are contained in amounts of from 0.1 to 100 % by mole and from 0 to 99.9 % by mole, respectively, and

(2) a fluorine-containing resin (II) which is soluble in general purpose solvents, has a fluorine content of not less than 1 % by weight and not more than 35 % by weight and comprises a fluorine-containing ethylenic polymer (IAB) having a moiety A and moiety B in at least a part of the same side chain or different side chains thereof or a fluorine-containing ethylenic polymer (IA) having a moiety A in at least a part of its side chain, in which the moiety A has, at its end, one or two or more polyfluoropolyether chains P represented by the formula (1):



wherein n1, n2, n3 and n4 are the same or different and each is 0 or an integer of 1 or more and n1 + n2 + n3 + n4 is an integer of 7 to 40; X<sup>1</sup> are the same or different and each is H, F or Cl; Rf is a fluorine-containing alkyl group having 1 to 10 carbon atoms, an ethylenic polymer moiety MA remaining by excluding the moiety A and the moiety B from the fluorine-containing ethylenic polymer constituting the resin (II) does not contain fluorine atom or is an ethylenic polymer moiety in which a part of hydrogen atoms thereof are replaced by fluorine atoms up to a fluorine content of not more than 10 % by weight.

12. A method of forming a cured article which comprises; coating a liquid composition comprising:  
(i) the material (e) for antireflection film of Claim 10 or the curable



- fluorine-containing resin (III) of Claim 11,
- (ii) the fluorine-containing resin (II) of Claim 10, and
- (iii) a solvent;
- drying to form a coating film; and
- 5 curing the coating film.

13. The method of Claim 12, wherein the cured article is an antireflection film.